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Applicants	:	PARK et al.
Serial No.	:	10/527,261 (U.S. Patent Application Publication 2006-0024226)
Filing Date	:	9 March 2005
For	:	**CATALYST AND METHOD FOR DECOMPOSITION OF PERFLUORO-COMPOUND IN WASTE GAS**
Examiner	:	Patricia L. Hailey
Art Unit	:	1755

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DECLARATION UNDER 37 C.F.R. § 1.132

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I, Dr. PARK, Yong-ki of 119-302 Hanbil Apt., Uheun-dong, Yusung-gu, Daejon 205-755, Republic of Korea, a citizen of KOREA, hereby declare:

- that I am a chemist having studied at Department of Chemical Engineering in Seoul National University (B.S.)
- that I have a doctorate degree which was awarded to me by Korea Advanced Institute of Science and Technology (KAIST) in 1994;
- that I have a researcher in the area of chemical engineering in Korea Advanced Institute of Science and Technology (KAIST) from 1994-1995;
- that I was a researcher in the area of chemical engineering in University of California from 1995-1996;
- that I have been employed as a researcher for the Korea Research Institute of Chemical Technology since 1996;
- that I am the author or co-author of the following publications:

Publications

1). Y.-K. Park, W.C. Choi, S.Y. Jeong, C.W Lee, "High Value-added Technology of Oil San d", Kor. Chem. Eng. Res., 45(2), 109-116 (2007).

2). S.H.R. Abdi, Y.J. Kim, Y.-K. Park, C.W. Lee, "Nano Bowls of Carbon by Oxidative Chop ping of Carbon Nano Sphere", Chem. Lett. 36(10), 1202-1203 (2007).

3). J. Noh, Y.D. Suh, Y.-K. Park, S.M. Jin, S.H. Kim, S.I. Woo, "Combined micro-Raman/U V-visible/fluorescence spectrometer for high-throughput analysis of microsamples", Rev. of Sci. Inst., 78, 072205 (2007).

4). X.-F. Xu, J.Y. Jeon, M.H. Choi, H.Y. Kim, W.C. Choi, Y.-K. Park, "The modification and stability of r-Al_2O_3 based catalysts for hydrolytic decomposition of CF_4", J. Molecular Cat alysis A, 266, 131-138 (2007).

5). H.J. Jung, S.S. Park, C.-H. Shin, Y.-K. Park, S.B. Hong, "Comparative catalytic studies on the conversion of 1-butene and n-butene to isobutene over MCM-22 and ITQ-2 zeolites, J. Catal., 245, 65-74 (2007).

6). Z.–X. Liu, J.-N. Park, S.H.R. Abdi, S.-K. Park, Y.-K. Park, C.W. Lee, "Nano-sized carbon hollow spheres for abatement of ethylene", Topics in Catalysis, 39(3), 221-226 (2006).

7). J.-B. Lee, Y.-K. Park, O-B. Yang, Y.K. Kang, K.-W. Jun, Y.-J. Lee, H.Y. Kim, K.-H. Lee, W.C. Choi, "Synthesis of porous carbons having surface functional groups and their appli cation to direct-methnanol fuel cells", J. Power Sources, 158, 1251-1255 (2006).

8). K.S Oh, Y.-K. Park, S.I. Woo, "Highly reliable 64-channel sequential and parallel tubular reactor system for high-throughput screening of heterogeneous catalysts", Review Scientifi c Instruments, 76, 062219 (2005)

9). J.K. Lee, Y.-K. Park, K.Y. Choi, H.Y. Kim, C.W. Lee, "Fabrication of mesoporous carbon materials from non-mesoporous silica spheres templates", Bull. Korean Chem. Soc. 26(5), 709-710 (2005).

10). J.H. Kim, W.C. Choi, H.Y. Kim, K.Yong, Y.-K. Park, "Preparation of mono-dispersed mi xed metal oxide micro hollow spheres by homogeneous precipitation in a micro precipitato r", Powder Technology, 153, 166-175 (2005).

11). J.K. Lee, S.Y. Han, S.-K. Park, Y.-K. Park, C.W. Lee, "Activation of nano-sized carbon sh ells on cabon hollow spheres under water vapor", Korean J. Chem. Eng., 22(1), 42-45 (200 5).

12). X.-F. Xu, J.Y. Jeon, M.H. Choi, H.Y. Kim, W.C. Choi, Y.-K. Park, "A Strategy to protect Al_2O_3-based PFC decomposition catalyst from deactivation", Chem. Lett., 34(3), 364 (200 5).

13). J.-W. Park, J.-H. Jung, W.-L. Yoon, C. S. Kim, D.-K. Lee, Y.-K. Park, Y.-W. Rhee, "Selec tive oxidation of CO in hydrogen-rich stream over Cu-Ce catalyst promoted with transition metals," *J. of Hydrogen Energy*, 30, 209 (2005).

14). J.-W. Park, J.-H. Jung, W.-L. Yoon, H. Jung, H.-T. Lee, D.-K. Lee, Y.-K. Park, Y.-W. Rhe e, "Activity and characterization of Co-promoted CuO-CeO_2/γ-Al_2O_3 catalyst for the select ive oxidation of CO in excess hydrogen," *Appl. Catal. (A)*, 274, 25 (2004).

15). J. Wang, J.-N. Park, Y.-K. Park, S.Y. Han, J.-O. Baek, C.W. Lee, "On the isopropylation o f naphthalene over zeolite catalysts in the high-pressure fixed-bed flow reactor," *Catal. To day*, 97, 283 (2004).

16). S.Y. Han, C.W. Lee, J.R. Kim, N.S. Han, W.C. Choi, C.H. Shin, Y.-K. Park, "Selective for mation of light olefins by the cracking of heavy naphtha over acid catalysts," *Stud. Surf. Sc i. & Catal.*, 153, 157 (2004).

17). T. Chen, N.Y. Kang, C.W. Lee, H.Y. Kim, S.B. Hong, H.D. Roh, Y.-K. Park, "Three-step reactions for selective production of 2,6-rich dimethylnaphthalene from 2,7-rich dimethyln aphthalene," *Catal. Today*, 93-95, 371 (2004).

18). J.Y. Jeon, X.-F. Xu, M.H. Choi, H.Y. Kim, Y.-K. Park, "Hydrolytic decomposition of PFC s over $AlPO_4$-Al_2O_3 catalyst," *Chem. Comm.* 1244 (2003).

19). J.Wang., J.-N. Park, Y.-K. Park, and C.W. Lee, "Isopropylation of naphthalene by isoprop yl alcohol over USY catalyst: an investigation in the high-pressure fixed-bed flow reacto r", *J. Catal.*, 220, 265 (2003).

20). Y.-K. Park, J.Y. Jeon, S.Y. Han, J.R. Kim, and C.W. Lee, "Catalytic cracking of naphtha i nto light olefins," *HWAHAK KONGHAK*, 41(5), 549 (2003).

21). J.W. Park, Y.W. Lee, J.H. Jeong, D.L. Lee, Y.-K. Park, and W.L. Yoon, "Selective oxidati on of CO in hydrogen rich stream over Cu-Ce/γ-Al_2O_3 catalyst doped with Co (II)," *HWA HAK KONGHAK*, 41(5), 564 (2003).

22). J.W. Park, Y.W. Lee, J.H. Jeong, D.L. Lee, Y.-K. Park, and W.L. Yoon, "Selective oxidati on of CO in hydrogen rich stream over Cu-Ce/γ-Al_2O_3 catalyst doped with Co (I)," *HWAH AK KONGHAK*, 41(4), 445 (2003).

23). H.-S. Roh, Y.-K. Park, and S.-E. Park, "Direct decomposition of NO over plasma-assisted catalytic system induced by microwave irradiation," *J. Ind. Eng. Chem.*, 9(4), 341 (2003).

24). S.-H. Lee, D.-K. Lee, C.-H. Shin, Y.-K. Park, P.A. Wright, W.M. Lee, and S.B. Hong, "Sy nthesis, characterization, and catalytic properties of zeolites IM-5 and NU-88," *J. Catal.*, 2 15, 151 (2003).

25). S.I. Woo, D.K. Kim, Y.-K. Park, M.R. Kim, and P. Decyk, "Wide temperature window in the catalytic activity of novel Pt/ZSM-5 prepared by a sublimation method for selective cat alytic reduction of NO," *Catal. Lett.*, 85(1), 69 (2003).

26). Bo-Hyuk Jang, Tae-Hun Yeon, Hyun-Sik Han, Yong-Ki Park, and Jae-Eui Yie, "Deteriora tion mode of barium cantaining NOx storage catalyst," *Catal. Lett.*, 77, 21 (2001).

27). Y.S. Choi, Y.-K. Park, J.-S. Chang, Anthony K. Cheetham and S.-E. Park, "Oxidative de hydrogenation of 4-vinylcyclohexene into styrene over ZrO_2 catalyst promoted with Fe_2O_3 and CaO," *Catal. Lett.*, 69, 93 (2000).

28). S.-K. Park, Y.K. Park, S.-E. Park, and Larry Kevan, "Comparison of Selective Catalytic Reduction of NO with C_3H_6 and C_3H_8 over Cu(II)-ZSM-5 and Co(II)-ZSM-5," *Phys. Che m. Chem. Phys.*, V2, 5500 (2000).

29). C.W. Lee, W.J. Lee, Y. K. Park, and S.-E. Park, "Catalytic Hydroxylation of Benzene ov er Vanadium-containing Molecular Sieves," *Catal. Today*, 61, 137 (2000).

30). J.W. Yoo, C.W. Lee, H.-C. Jeong, Y.K. Park, and S.-E. Park "t-Butylation of 1,2-dihydro xy benzene over Acidic Zeolites," *Catal. Today*, 60, 255 (2000).

31). H.M. Sung-Suh, D.S. Kim, Y.-K. Park, and S.-E. Park,"Spectroscopic Monitoring for th Formation of Mesoporous MCM-41 Materials upon Microwave Irradiation", *Res. Chem. Intermed.* 26(3), 283 (2000).

32). H.-S. Roh, Y.-K. Park, and S.-E. Park, "Superior Decomposition of NO over Plasma-Assi sted Catalytic System Induced by Microwave", *Chem. Lett.*, 578 (2000).

33). Y.K. Park, J.W. Lee, C.W. Lee, and S.-E. Park, "Mechanistic Study of SCR-NO with Me thane over Pd-loaded BEA Zeolite", *J. Mol. Catal. A*, 158,173 (1999).

34). H.-S. Roh, M.S, Park, J.-S, Chang, Y.-K. Park, and S.-E. Park, "Dehydrogenation of Prop ane over Pd-Composite Membrane", *J. Ind. & Eng. Chem.*, 5, 198 (1999).

35). L. Huang, C.W. Lee, Y.K. Park, and S.-E. Park, "Highly Selective Epoxidation of 1-Pent ene with H2O2 over TS-1", *Bull. Korean Chem. Soc.*, 20(6), 747 (1999).

36). S.-E. Park, J.W. Yoo, W.J. Lee, C.W. Lee, J.-S. Chang, and Y.K. Park "Direct Formation of Hydrogen Peroxide with H2 and O_2 over Anthraquinone Encapsulated Pd-Y Zeolite", *Bull. Korean Chem. Soc.*, 20(1), 21(1999).

37). J.S. Kim, Y.K. Park, J.-S. Chang, C.W. Lee, and S.-E. Park, "Computational Study of N Ox Adsorption in Co-ZSM-5 Zeolite", *Proc. 12th Int. Zeolite Conf. MRS, Washington*, V 1, 437 (1999).

38). Y.K. Park, S.S. Goryashenko, D.S. Kim, S.-E. Park, "The Role of Cobalt Oxide Species i n the SCR of NO with Propylene on Co-Loaded ZSM-5 Catalysts," *Proc. 12th Int. Zeolit e Conf. MRS*, Washington, Vol2, 1157 (1999).

39). Y.K. Park, H.-S. Roh, E.K. Lee, and S.-E. Park, "The Removal of NOx by Microwave-In duced Adsorption-Desorption Cycle", *Appl. Chem.* 3(1), 173 (1999).

40). J.W. Yoo, C.W. Lee, Y.K. Park, "FT-IR and XPS Study of Zeolite in the tert-Butylation of 1,2-Dihydroxybenzene", *Appl. Chem.* 3(1), 417 (1999).

41). S.S. Goryashenko, Y.K. Park, D.S. Kim, and S.-E. Park, "Mechanistic study of the SCR o f NO with Propylene over Co/ZSM-5 Using in-situ FTIR," *Res. Chem. Intermed.*, 24(9), 933 (1998).

42). Y.-K. Park, Fabio H. Ribeiro, and G.A. Somorjai, "The Effect of Potassium and Tin on th e Hydrogenation of Ethylene and Dehydrogenation of Cyclohexane over Pt(111)", *J. Cat al.*, 178, 66 (1998).

43). J.-S. Chang, S.-E. Park, H.-S. Roh, and Y.K. Park, Thermogravimetric Study on Reactivit y of Carbon Dioxide and Methane over Supported Nickel Reforming Catalysts, *Bull. Ko r. Chem. Soc.*, 19(8), 809 (1998).

44). Yong-Ki Park, Do Heui Kim and Seong Ihl Woo, "Aromatization of Pentane Catalyzed o ver Various Metallosilicates", *Kor. J. Chem. Eng.*, 14(4), 249 (1997).

45). I.J. Park, Y.K. Park, and S.I. Woo, "Computer simulation of the effect of pumping rate on the oscillatory behavior in CO oxidation on Pd(110)", *Surf. Sci.*, 325, 243 (1995).

46). Y.K. Park, K.Y. Park and S.I. Woo, "Selective Alkylation of Aniline with Methanol over Various Metallosilicates Catalysts", *Catal. Lett.*, 26, 169 (1994).

47). J.C. Kim, Y.K. Park and S.I. Woo, "Catalytic Properties, Size and Location of Cobalt Clu sters Prepared by the Reduction of Cobalt Ion-Exchanged NaY", *J. Chem. Soc. Faraday Trans.*, 88, 1489 (1992).

48). S.B. Hong, C.G. Kim, Y.S. Uh, Y.K. Park and S.I. Woo, "Preparation and Characterizati on of Va-, Fe- and Ga-Silicate Catalysts in the Presence of Fluoride Ions", *Kor. J. Chem. Eng.*, 9, 16 (1992).

49). S.I. Woo, J.K. Lee, S.B. Hong, Y.K. Park and Y.S. Uh, "Selective Alkylation of Aniline with Methanol over Boronsilicate Molecular Sieve", *Stud. Surf. Sci. Catal.*, 49, 1095 (198 9).

Review Papers

1) S.-E. Park, C.W. Lee, and Y.K. Park, "New Horizon in Natural Gas Conversion Technology", Chem. Ind. and Tec. 17(2), 139 (1999).
2) S.-E. Park and Y.K. Park, "Synthesis of Fine Chemicals and Intermediates by Using Zeolites," *Catalysis*, 14(1), 36 (1998).
3) S.-E. Park and Y.K. Park, "Properties and Application of Zeolites," *Catal. Inform.,* (3), 17 (1997).
4) S.-E. Park and Y.K. Park, "Characteristics and Application of Zeolite Catalysts, *Fine Chemistry,* (2), 25 (1996).

I am a named inventor of U.S. Ser. No. 10/527,261 ("the '261 application") filed on 9 March 2005. I am familiar with the invention described in the '261 application and have reviewed the Office Action of 27 December 2007 ("the Office Action") regarding this application.

I understand that prior to the Office Action, our representative made an amendment to claim 5 (which is an independent claim in the '261 application) which is reproduced below:

5. (Currently amended) A method of catalytic decomposition of exhausted perfluoro-compounds, which comprises passing exhausted perfluoro-compounds through ~~the catalyst of claim 1~~ an aluminum oxide catalyst in the presence of water vapor at the temperature range of 400-800°C,

wherein the surface of said aluminum oxide is loaded with phosphorus (P) component at an aluminum/phosphorus mole ratio of 10 to 100;

wherein the aluminum oxide is formed from an aluminum precursor selected from the group consisting of Al_2O_3, $Al(OH)_3$, gamma alumina, boehmite and pseudo-boehmite and the phosphorous (P) component is selected from the group consisting of diammoniumhydrophosphate $(NH_4)_2HPO_4$, ammoniumdihydrophosphate $(NH_4)H_2PO_4$, and phosphoric acid H_3PO_4; and

wherein no additional metallic components are present in said aluminum oxide catalyst.

I understand the basis for the limitation "...wherein no additional metallic components are present in said aluminum oxide catalyst." (bold text in claim 5 above) was said to be supported at least in part by the passage in the specification on page 7, lines 17-20 of the application as filed which states "However, it is preferred to use phosphate compounds, which do not contain metal components, such as diammonium hydrophosphate ($(NH_4)_2HPO_4$, ammoniumdihydrophosphate ($NH_4H_2PO_4$) or phosphoric acid (H_3PO_4) for the catalytic activity and thermal durability."[1]

I understand that on page 4, lines 1-7 of the Office Action, the Examiner objected to our basis for support for the limitation "...wherein no additional metallic components are present in said aluminum oxide catalyst." by stating that the text on page 7, lines 17-20 of the specification "implies that the compounds providing the phosphorus component in the 'aluminum oxide catalyst' recited in the instant claims desirably do not contain metal components – ***not the aluminum oxide catalyst itself***." (emphasis added).

However, the Examiner's implication is incorrect. The state of the art with respect to the decomposition of perfluoro-compounds was such that previously known catalysts was such that

[1] Please note that the Examiner's citation ("Page 4, lines 17-20") and our representative's citation ("page 7, lines 20-24") as to the location of this passage was incorrect. The correct location is page 7, lines 17-20.

the degree of decomposition still was in need of improvement. The use of aluminum oxide catalysts which had additional metals added to the aluminum oxide catalyst was well know to us, e.g. U.S. Patent 6,162,957 which was discussed in the "Background Art" section of our specification (see page 4, lines 11-22 of the '261 application). However, these catalysts did not exhibit the unexpectedly superior decomposition activity of our claimed catalysts and also had the problem of short lifetimes when used in a process for the decomposition of perfluoro-compounds.

As such, the aluminum oxide catalysts of our invention were designed to be free of additional metal components in order to provide a more durable catalyst in addition to providing a catalyst with superior decomposition activity.

Each of the example catalysts provided in the "Best Mode" section of the '261 application, which are within the scope of claim 5 (Examples I-X), do not contain additional metal components and would be recognized as such by one of ordinary skill in the catalyst art. Moreover, given the state of the art, one of ordinary skill in the art would also recognize that the scope of aluminum oxides of claim 5 would not have included additional metal components even without the limitation "wherein no additional metallic components are present in said aluminum oxide catalyst.", i.e. this limitation is superfluous, but was added in an attempt to assist the Examiner understand the state of the art of technology at the time the invention was made.

For these reasons, the limitations added in claim 5 are supported by the application as originally filed.

The undersigned hereby declares as follows:

The undersigned further declares that all statements made herein of his or her own knowledge are true and that all statements made on information and belief are believed to be true; and that the foregoing statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: May 6, 2009 By: _____

Dr. PARK, Yong-ki